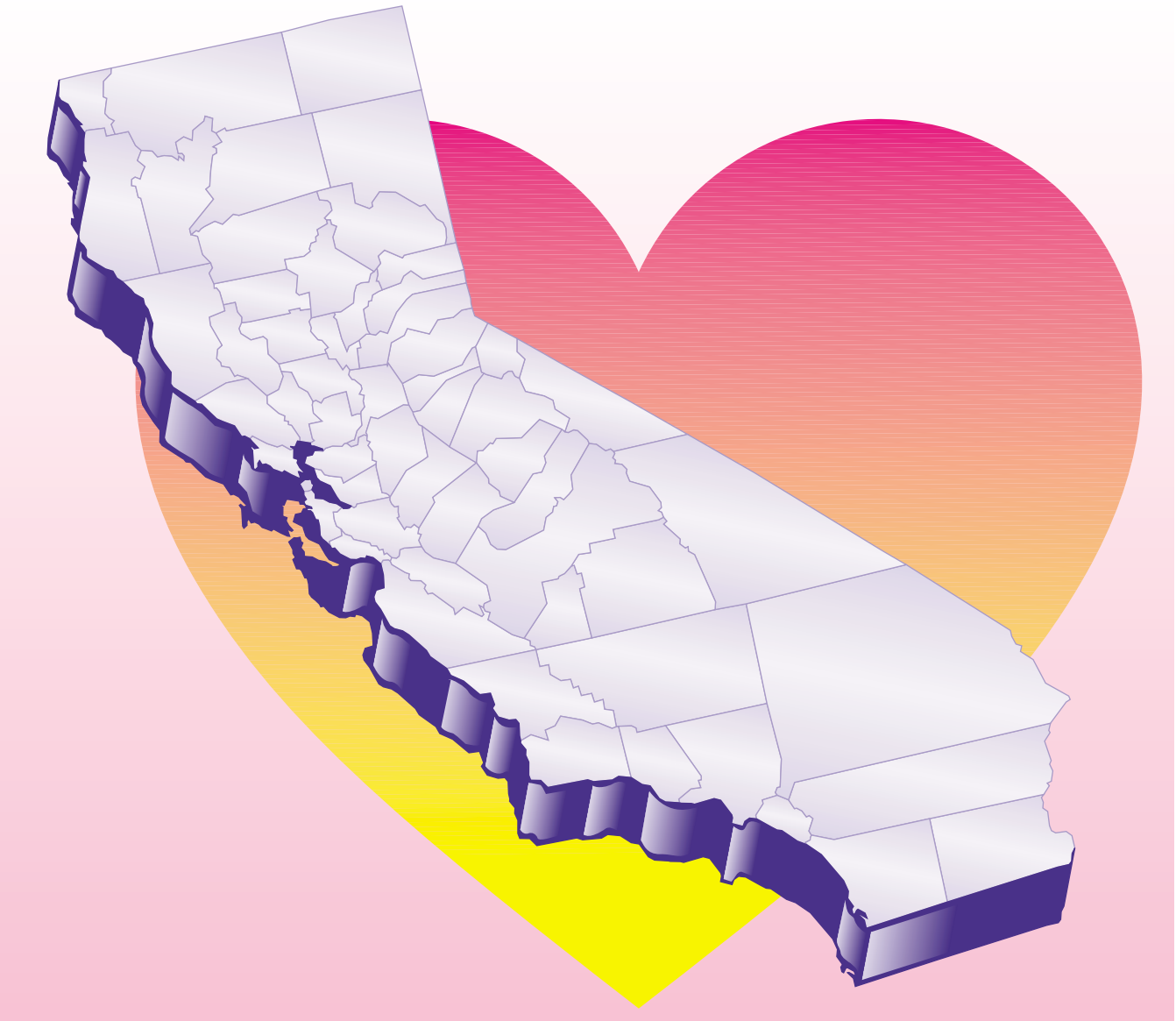
CORE Profiles...

The Burden of Cardiovascular Disease

CORE Cardiovascular Disease Outreach, Resources and Epidemiology PROGRAM Report Number 3

Deaths from Heart Disease and Stroke in California Counties



The Burden

OF CARDIOVASCULAR DISEASE:

Deaths from Heart Disease and Stroke in California Counties

CARDIOVASCULAR DISEASE OUTREACH, RESOURCES AND EPIDEMIOLOGY (CORE) PROGRAM

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

CALIFORNIA DEPARTMENT OF HEALTH SERVICES

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Acknowledgments

This is Report Number 3 in a series of reports on heart disease and stroke in California. It was prepared collaboratively by the Cardiovascular Disease Outreach, Resources and Epidemiology (CORE) Program of the University of California at San Francisco, Institute for Health & Aging, and the California Chronic and Sentinel Diseases Surveillance Program of the California Department of Health Services.

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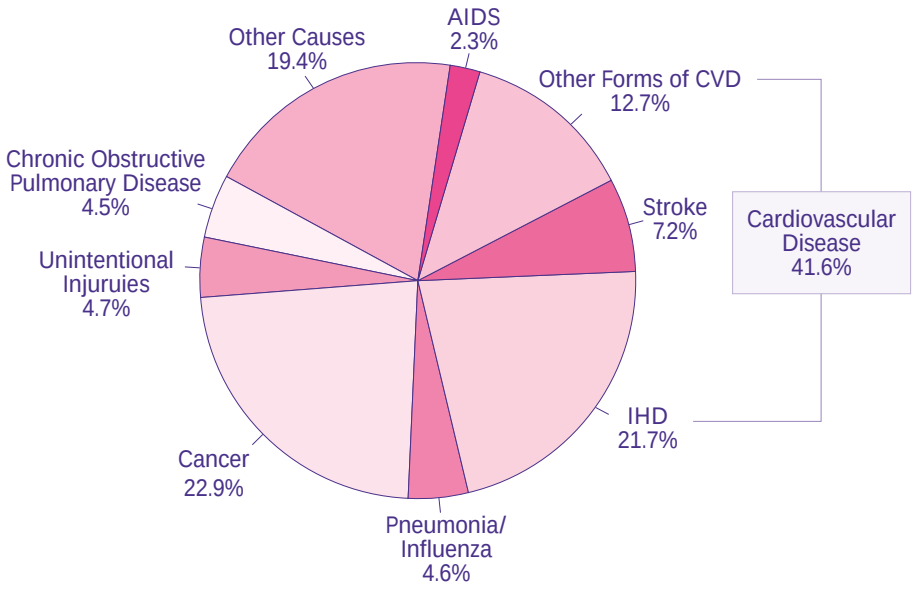
Cardiovascular diseases (CVD) are the leading cause of death for those over 40 years of age in the United States as well as California. Although there have been substantial declines in deaths from ischemic heart disease (IHD) and cerebrovascular disease, CVD remains a major public health problem. Figure 1 shows that CVD accounts for nearly 42 percent of all causes of death.

...Cardiovascular disease remains a major public health problem.

FIGURE 1: LEADING CAUSES OF DEATH IN CALIFORNIA, 1989-1991



The purpose of this report is to present age- and race-adjusted data on the mortality from IHD and stroke for all counties in California for 1989-1991.

Methods

MORTALITY DATA

Mortality data were compiled from the death record statistical master tapes of the California Department of Health Services, Health Data and Statistics Branch, Health Demographics Section. Cause of death on the tapes was coded according to the International Classification of Diseases, Ninth Revision (ICD-9). Cardiovascular disease refers to the underlying cause of death on the death certificate coded 390-459. Mortality data were generated for deaths among persons who were residents of California at the time of death and with the ICD-9 codes 410-414 for IHD and 430-438 for stroke, as the underlying cause of death. Deaths were aggregated for the three-year period 1989-1991.

POPULATION DATA

Population data by zip code were obtained for 1990 from the California Department of Finance, Population Research Unit. The aggregated population size for the three-year period of 1989-1991 was estimated by multiplying the 1990 population size by three. The population data for California zip codes does not separate Hispanics from other race/ethnic groups. Therefore, three race/ethnic groups were used in the analysis.

AGE AND RACE ADJUSTMENT

We examined death rates for IHD and stroke for each county in California. Mortality rates are expressed as numbers of deaths per 100,000 people. A detailed account of the age- and race-adjustments appears in Appendix A.

The 1990 California census population was used as the reference population and the direct method was used to standardize the mortality rates. We calculated ratios of age- and race-adjusted sex-specific rates for each county relative to the adjusted sex-specific rates for the entire State. We used an approximate large sample statistical test described by Flanders to evaluate whether the ratios were significantly different from one (1). This test indicates whether a county has a significantly higher or lower mortality rate compared to the California State rate. Maps 1-6 show counties, for both IHD and stroke, with significantly higher or lower age- and race-adjusted mortality rates, relative to the respective age- and race-adjusted state mortality rate.

STATEWIDE MORTALITY RATES

Forty-two percent of all California deaths, for the three-year period of 1989-1991, are due to CVD. Among 258,185 deaths, 70 percent were due to IHD and stroke.

As expected, the mortality rates for both IHD and stroke increases with age across all race/ethnicity groups (data available upon request). For both IHD and stroke, excluding the 75-year or older age group, blacks have significantly higher mortality rates compared to whites and the group designated as "other."

After adjusting for age, Table 1 shows that males have higher IHD attributable mortality compared to females. There are no significant differences in rates between white and black males for IHD; however, white and black females have significantly different rates. For stroke, Table 2 shows that there are substantially higher stroke age-adjusted mortality rates for black males and black females compared to whites and the "other" race/ethnicity groups. The stroke age-adjusted mortality rate for black men is 43% higher than the rate for white men. For black women, the rate is 36% higher compared to the rate for white women.

Cardiovascular diseases accounted for 42 percent of all deaths in California...

TABLE 1: AGE-ADJUSTED IHD MORTALITY RATES AND 95% CONFIDENCE INTERVALS PER 100,000 BY RACE AND GENDER, 1989-1991

GENDER	WHITE	BLACK	OTHER
MALE	210.34	210.18	77.83
	(208.69, 211.99)	(203.55, 216.97)	(75.06, 80.68)
FEMALE	134.41	165.08	43.79
	(133.35, 135.47)	(160.33 169.93)	(41.94, 45.70)

TABLE 2: AGE-ADJUSTED STROKE MORTALITY RATES AND 95% CONFIDENCE INTERVALS PER 100,000 BY RACE AND GENDER, 1989-1991

GENDER	WHITE	BLACK	OTHER
MALE	52.70	75.38	32.62
	(51.87, 53.54)	(71.46, 79.47)	(30.82, 34.48)
FEMALE	53.25	72.52	26.62
	(52.59, 53.93)	(69.40 75.74)	(25.20, 28.10)

These results suggest that IHD and stroke mortality rates for California vary not only among age strata, and different race/ethnicity groups, but also between genders. The California age- and race-adjusted mortality rates, per 100,000, for IHD are 195.36 for males and 127.51 for females. For stroke the rates are 50.47 and 50.17 for males and females, respectively.

MORTALITY RATES BY COUNTY

All county mortality rates were compared to the State rate, for the respective disease. Table 3 shows the five California counties with the highest and Table 4 the five counties with the lowest death rates by gender for IHD. Tables 5 and 6 present similar information for stroke. San Bernardino County has the highest IHD death rate for males, females, and total. It is also among the top five counties listed for stroke deaths for males and total. Kern, Tulare, and Riverside Counties are listed among the highest adjusted death rates for both males and females for IHD. However, for females, Riverside County has one of the lowest adjusted death rates for stroke. Maps 1-3 for IHD and Maps 4-6 for stroke display a broader view of the geographical variations in the CVD mortality rates among California counties. Tables 8 and 10 provide a comprehensive list of mortality rates for all counties for IHD and stroke. The 90 percent confidence intervals for the age- and race-adjusted mortality rates for all counties are shown in Appendix B.

There were substantial variations in the pattern of deaths among the different counties (Maps 1-6). For example, there is over a two-fold difference between the county with the highest death rate (San Bernardino) for IHD compared to the county with the lowest death rate (Plumas). For stroke, there is a two-fold difference between the county the highest death rate (Monterey) compared to the county with the lowest death rate (El Dorado). The reasons for this geographic variation are not known.

The rates also vary substantially by gender. For example, there is two-fold difference for females between the county with the highest IHD death rate (San Bernardino) compared to the county with the lowest death rate (El Dorado). For males, there is more than a two-fold difference between the county with the highest IHD death rate (San Bernardino) compared to the lowest (Plumas).

TABLE 3: CALIFORNIA COUNTIES WITH THE SIGNIFICANTLY HIGHEST IHD MORTALITY RATES BY GENDER, 1989-1991

MALE		FEMALE		TOTAL	
COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE
San Bernardino	263.24	San Bernardino	170.15	San Bernardino	210.83
Kern	262.97	Kern	165.22	Kern	208.29
Imperial	249.16	Los Angeles	147.96	Tulare	191.07
Tulare	247.08	Tulare	147.53	Riverside	184.86
Riverside	230.53	Riverside	147.05	Kings	183.45

Death rates are age- and race-adjusted. The 1990 California census population is the reference population used in the direct standardization method.

TABLE 4: CALIFORNIA COUNTIES WITH THE SIGNIFICANTLY LOWEST IHD MORTALITY

Rates by Gender, 1989-1991

MALE		FEMALE		TOTAL	
COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE
Plumas	107.52	El Dorado	79.48	Plumas	99.69
Nevada	124.58	Nevada	83.07	Nevada	99.90
El Dorado	125.11	Santa Barbara	84.85	Santa Barbara	107.08
Amador	131.12	Tuolumne	86.53	Amador	111.41
Santa Barbara	138.51	Monterey	88.02	Butte	114.18

Death rates are age- and race-adjusted. The 1990 California census population is the reference population used in the direct standardization method.

Table 5: California Counties with the Significantly Highest Stroke Mortality Rates by Gender, 1989-1991

MALE		FEMALE		TOTAL	
COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE
Imperial	71.06	Inyo	87.75	Monterey	61.46
San Joaquin	62.85	Marin	66.86	San Joaquin	60.96
Alameda	59.90	Monterey	63.64	Alameda	58.29
San Francisco	58.98	Solano	63.42	San Bernardino	56.81
San Bernardino	58.02	San Mateo	58.18	San Francisco	56.62

Death rates are age- and race-adjusted. The 1990 California census population is the reference population used in the direct standardization method.

Table 6: California Counties with the Significantly Lowest Stroke Mortality Rates by Gender, 1989-1991

MALE		FEMALE		TOTAL	
COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE	COUNTY	MORTALITY RATE
El Dorado	28.10	El Dorado	31.74	El Dorado	29.96
Ventura	41.01	Riverside	45.57	Calaveras	33.49
San Diego	45.31	•	•	Ventura	44.71
•	•	•	•	Fresno	46.07
•	•	•	•	Kern	46.33

Death rates are age- and race-adjusted. The 1990 California census population is the reference population used in the direct standardization method.

- *Insufficient data was available.*

For stroke, there is almost a three-fold difference for females between the county with the highest stroke death rate (Inyo) compared to the county with the lowest death rate (El Dorado). For males, there is over a two-fold difference between the county with the highest death rate (Imperial) compared to the county with the lowest (El Dorado).

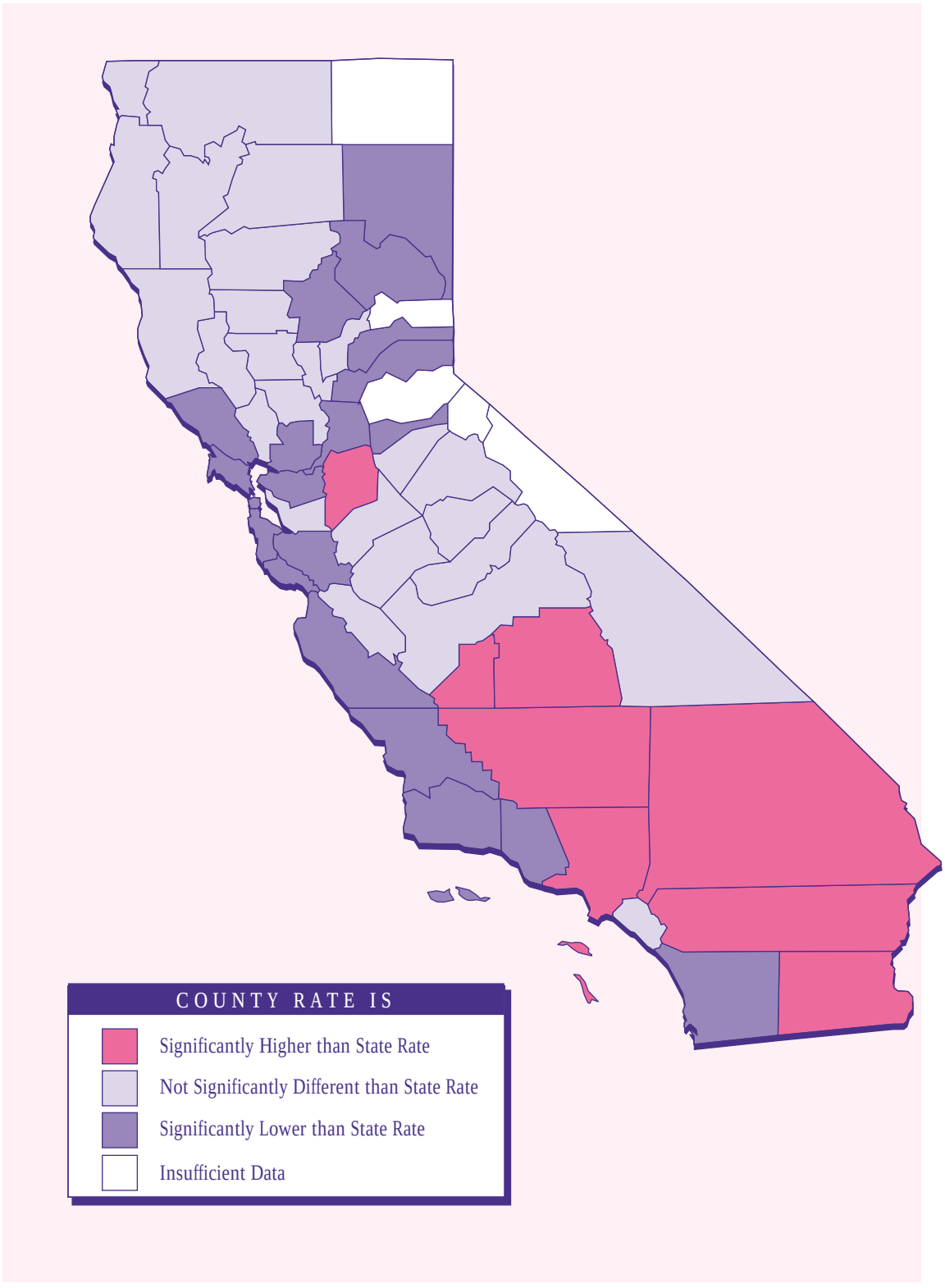
Discussion

There is a great need to ...enhance public health efforts to improve both prevention and treatment for heart disease and stroke.

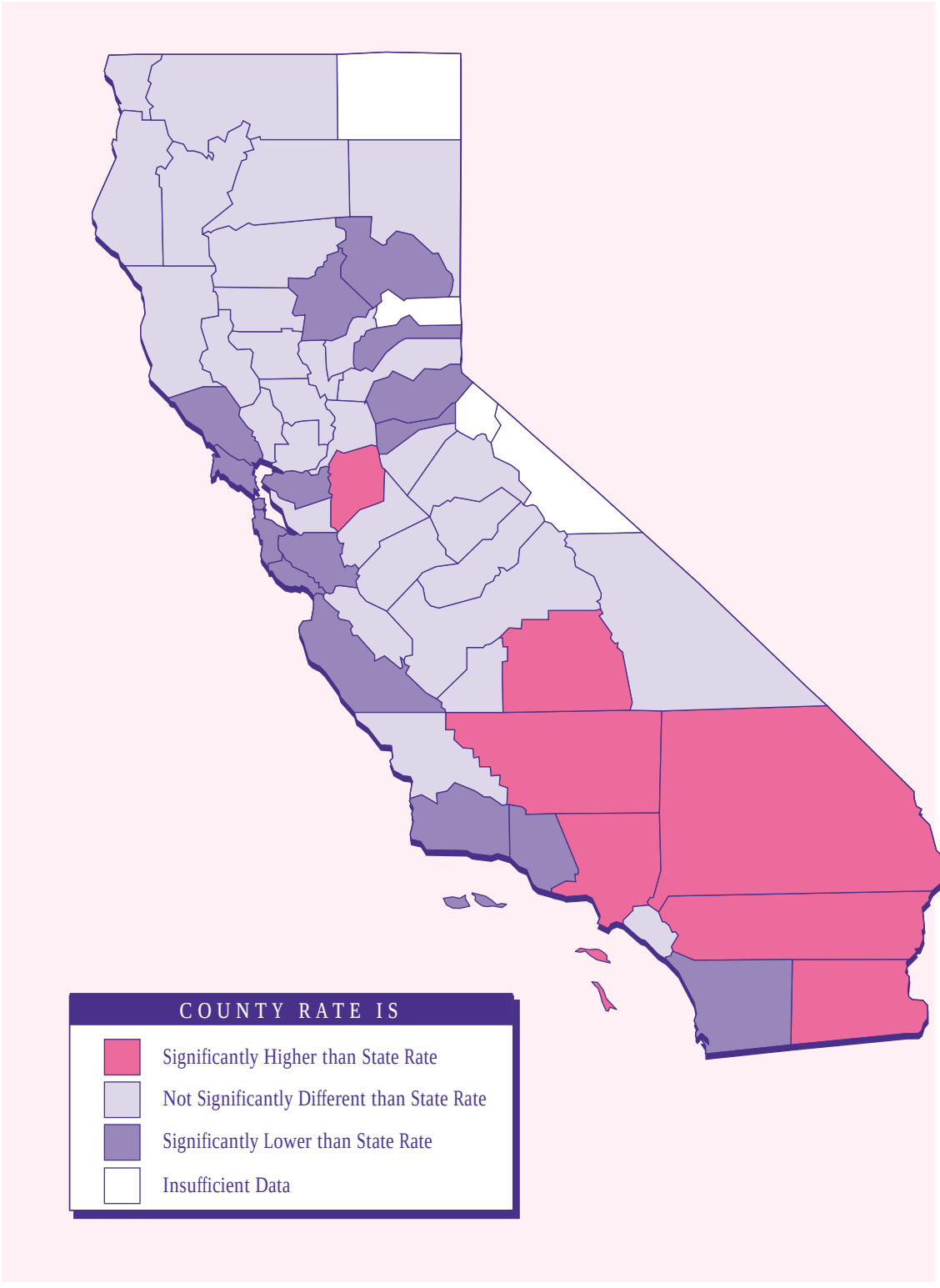
Cardiovascular diseases, including heart disease and stroke, contribute a substantial burden to California mortality. The combination of heart disease and stroke accounted for 42 percent of all deaths in California between 1989-1991. This is particularly tragic considering the preventability of most deaths from CVD through: tobacco cessation; improved prevention of high blood cholesterol, high blood pressure, obesity, and diabetes; and promotion of healthier eating and physical activity.

These variations in death rates should be a source of considerable public health concern. The reasons for these differences are not known, but may be explained by differences in exposure to risk factors, access to preventive medical care and screening, differences in treatment, and differences in patterns of survival. There is a great need to address these differences and to continue to enhance public health efforts to improve both prevention and treatment for heart disease and stroke.

Map 1: Counties with IHD Mortality Rates Significantly Different from the State Rate for Males and Females in California, 1989-1991



MAP 2: COUNTIES WITH IHD MORTALITY RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR MALES IN CALIFORNIA, 1989-1991



Map 3: Counties with IHD Mortality Rates Significantly Different from the State Rate for Females in California, 1989-1991

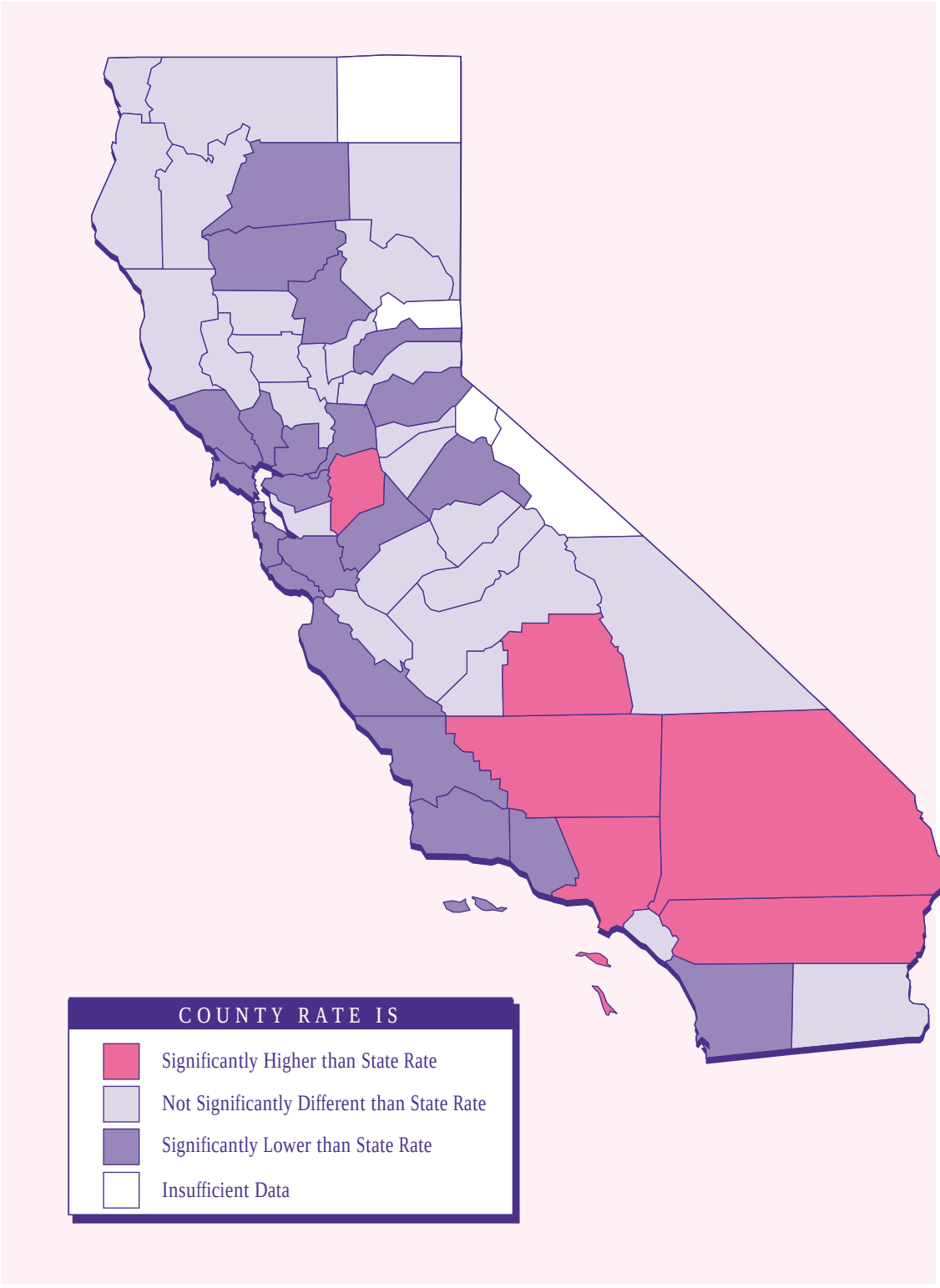


TABLE 7: IHD DEATHS BY COUNTY FOR CALIFORNIA, 1989-1991

PLACE	MALE NUMBER	MALE PERCENT OF ALL DEATHS	FEMALE NUMBER	FEMALE PERCENT OF ALL DEATHS	TOTAL NUMBER	TOTAL PERCENT OF ALL DEATHS
CALIFORNIA	70,509	20.8	69,660	22.8	140,169	21.7
Alameda	2,892	19.0	2,912	20.2	5,804	19.6
Alpine	0	0.0	1	20.0	1	8.3
Amador	100	22.1	87	24.2	187	23.1
Butte	591	19.5	485	18.5	1,076	19.1
Calaveras	132	24.7	86	20.3	218	22.8
Colusa	53	23.1	44	23.7	97	23.4
Contra Costa	1,612	18.3	1,625	19.0	3,237	18.7
Del Norte	63	18.0	43	15.5	106	16.9
El Dorado	275	19.4	199	16.7	474	18.4
Fresno	1,583	20.4	1,555	22.9	3,138	21.6
Glenn	71	19.4	65	20.1	136	19.7
Humboldt	384	22.1	175	18.5	659	20.4
Imperial	333	22.5	198	21.1	531	21.9
Inyo	79	26.6	57	18.7	136	22.6
Kern	1,656	24.7	1,423	26.5	3,079	25.5
Kings	231	23.5	192	21.7	423	22.6
Lake	252	20.6	222	22.8	474	21.6
Lassen	60	21.1	42	20.0	102	20.6
Los Angeles	19,396	19.6	22,297	24.8	41,693	22.1
Madera	268	23.0	223	24.8	491	23.8
Marin	509	19.9	490	18.1	999	19.0
Mariposa	55	25.1	49	25.4	104	25.2
Mendocino	270	22.6	199	18.8	469	20.8
Merced	392	21.4	327	20.8	719	21.1
Modoc	26	17.8	16	12.1	42	15.1
Mono	7	13.0	4	12.1	11	12.6
Monterey	647	18.8	522	16.3	1,169	17.6
Napa	441	24.6	320	20.4	761	22.6
Nevada	235	20.9	183	17.9	418	19.5
Orange	5,266	24.0	5,520	25.3	10,786	24.6
Placer	424	20.8	377	20.0	801	20.4

(Continued)

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

TABLE 7: (CONTINUED) IHD DEATHS BY COUNTY FOR CALIFORNIA, 1989-1991

PLACE	MALE NUMBER	MALE PERCENT OF ALL DEATHS	FEMALE NUMBER	FEMALE PERCENT OF ALL DEATHS	TOTAL NUMBER	TOTAL PERCENT OF ALL DEATHS
CALIFORNIA	70,509	20.8	69,660	22.8	140,169	21.7
Plumas	51	20.2	49	18.4	100	19.3
Riverside	4,310	26.8	3,699	27.9	8,009	27.3
Sacramento	2,320	19.4	2,227	20.3	4,547	19.8
San Benito	74	21.1	70	21.7	144	21.4
San Bernardino	3,988	25.1	3,640	26.6	7,628	25.8
San Diego	5,419	20.4	5,244	21.5	10,663	20.9
San Francisco	1,944	13.4	2,015	19.5	3,959	16.0
San Joaquin	1,417	22.8	1,262	24.3	2,679	23.5
San Luis Obispo	646	25.1	583	23.1	1,229	24.1
San Mateo	1,685	23.1	1,416	19.7	3,101	21.4
Santa Barbara	740	19.1	726	18.6	1,466	18.9
Santa Clara	2,439	19.5	2,525	20.6	4,964	20.0
Santa Cruz	471	18.9	545	21.5	1,016	20.2
Shasta	473	21.4	363	19.1	836	20.3
Sierra	12	23.1	8	22.2	20	22.7
Siskiyou	171	23.3	149	24.9	320	24.0
Solano	633	19.3	491	16.6	1,124	18.0
Sonoma	1,027	20.1	949	19.5	1,976	19.8
Stanislaus	942	21.0	801	20.5	1,743	20.7
Sutter	192	21.9	149	19.5	341	20.8
Tehama	208	22.4	136	18.5	344	20.6
Trinity	57	25.7	25	16.2	82	21.8
Tulare	974	24.3	858	24.9	1,832	24.5
Tuolumne	164	23.4	114	20.5	278	22.2
Ventura	1,311	21.6	1,156	20.2	2,467	20.9
Yolo	349	21.6	293	22.5	642	22.0
Yuba	189	22.9	129	21.3	318	22.2

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

TABLE 8: AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) AND RELATIVE RATES FOR IHD BY COUNTY, 1989-1991

	MALE		FEMALE		TOTAL	
PLACE	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE
CALIFORNIA	195.36	1.00	127.51	1.00	156.94	1.00
Alameda	194.17	0.99	122.19	0.96	152.64	0.97
Alpine	•	•	•	•	•	•
Amador	131.12	0.67*	95.85	0.75	111.41	0.71*
Butte	148.30	0.76*	86.97	0.68*	114.18	0.73*
Calaveras	187.98	0.96	93.48	0.73	136.09	0.87
Colusa	218.85	1.12	123.88	0.97	166.22	1.06
Contra Costa	161.75	0.83*	107.20	0.84*	129.83	0.83*
Del Norte	171.46	0.88	100.00	0.78	129.67	0.83
El Dorado	125.11	0.64*	79.48	0.62*	•	•
Fresno	204.68	1.05	130.60	1.02	162.27	1.03
Glenn	160.25	0.82	104.08	0.82	128.90	0.82
Humboldt	211.70	1.08	107.37	0.84	154.03	0.98
Imperial	249.16	1.28**	125.16	0.98	182.39	1.16**
Inyo	218.29	1.12	91.55	0.72	140.90	0.90
Kern	262.97	1.35**	165.22	1.30**	208.29	1.33**
Kings	234.10	1.20	145.08	1.14	183.45	1.17**
Lake	193.29	0.99	121.42	0.95	153.60	0.98
Lassen	139.27	0.71	98.88	0.78	116.54	0.74*
Los Angeles	207.31	1.06**	147.96	1.16**	173.47	1.11**
Madera	214.11	1.10	139.51	1.09	174.48	1.11
Marin	147.69	0.76*	96.69	0.76*	118.84	0.76*
Mariposa	167.31	0.86	123.47	0.97	168.44	1.07
Mendocino	205.46	1.05	107.08	0.84	150.79	0.96
Merced	201.59	1.03	121.74	0.95	156.85	1.00
Modoc	•	•	•	•	•	•
Mono	•	•	•	•	•	•
Monterey	161.75	0.83*	88.02	0.69*	119.87	0.76*
Napa	208.93	1.07	98.06	0.77*	149.24	0.95
Nevada	124.58	0.64*	83.07	0.65*	99.90	0.64*
Orange	203.98	1.04	130.93	1.03	161.29	1.03
Placer	164.83	0.84	104.07	0.82	130.72	0.83*

(Continued)

Notes: *Relative rate is ratio of county to statewide rate.*

* *County has significantly lower rate than state rate with an overall significance level of 0.10.*

** *County has significantly higher rate than state rate with an overall significance level of 0.10.*

• *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

TABLE 8: (CONTINUED) AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) AND RELATIVE RATES FOR IHD BY COUNTY, 1989-1991

PLACE	MALE		FEMALE		TOTAL	
	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE
CALIFORNIA	195.36	1.00	127.51	1.00	156.94	1.00
Plumas	107.52	0.55*	91.92	0.72	99.69	0.64*
Riverside	230.53	1.18**	147.05	1.15**	184.86	1.18**
Sacramento	187.42	0.96	118.26	0.93*	147.83	0.94*
San Benito	150.87	0.77	119.43	0.94	136.95	0.87
San Bernardino	263.24	1.35**	170.15	1.33**	210.83	1.34**
San Diego	168.83	0.86*	109.80	0.86*	135.82	0.87*
San Francisco	177.95	0.91*	108.10	0.85*	137.97	0.88*
San Joaquin	223.68	1.14**	142.08	1.11**	178.18	1.14**
San Luis Obispo	177.01	0.91	106.03	0.83*	138.91	0.89*
San Mateo	179.55	0.92*	99.54	0.78*	134.14	0.85*
Santa Barbara	138.51	0.71*	84.85	0.67*	107.08	0.68*
Santa Clara	169.61	0.87*	109.66	0.86*	134.48	0.86*
Santa Cruz	147.67	0.76*	104.41	0.82*	123.09	0.78*
Shasta	200.51	1.03	102.51	0.80*	141.45	0.90
Sierra	•	•	•	•	•	•
Siskiyou	197.05	1.01	134.79	1.06	162.91	1.04
Solano	184.15	0.94	109.64	0.86*	142.48	0.91*
Sonoma	156.85	0.80*	100.37	0.79*	123.98	0.79*
Stanislaus	194.27	0.99	108.61	0.85*	146.39	0.93
Sutter	210.09	1.08	108.03	0.85	150.75	0.96
Tehama	198.71	1.02	93.34	0.73*	137.18	0.87
Trinity	197.82	1.01	79.72	0.63	135.87	0.87
Tulare	247.08	1.26**	147.53	1.16**	191.07	1.22**
Tuolumne	162.89	0.83	86.53	0.68*	126.39	0.81
Ventura	167.72	0.86*	100.40	0.79*	129.19	0.82*
Yolo	208.37	1.07	120.98	0.95	160.14	1.02
Yuba	227.57	1.16	133.82	1.05	175.81	1.12

Notes: *Relative rate is ratio of county to statewide rate.*

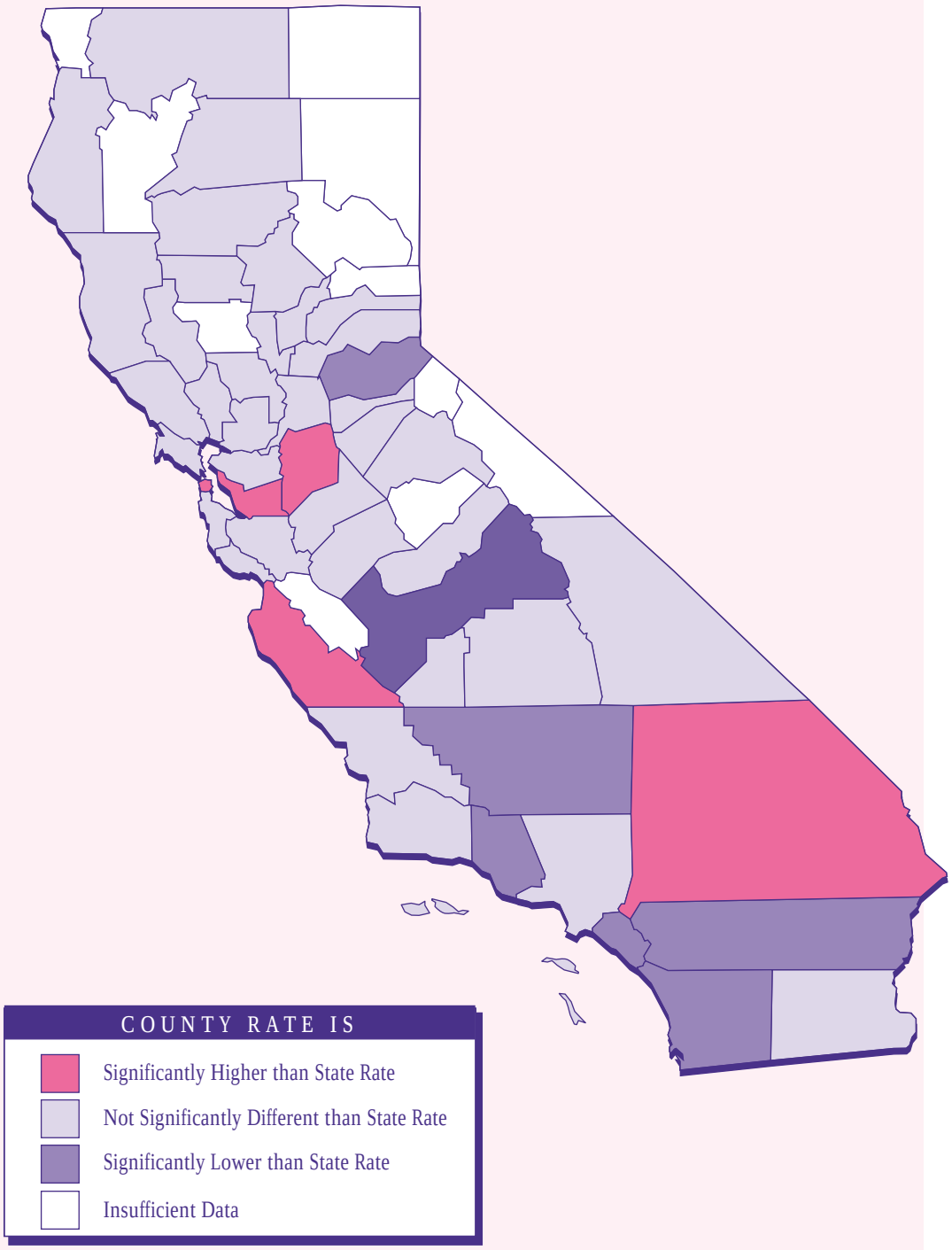
* *County has significantly lower rate than state rate with an overall significance level of 0.10.*

** *County has significantly higher rate than state rate with an overall significance level of 0.10.*

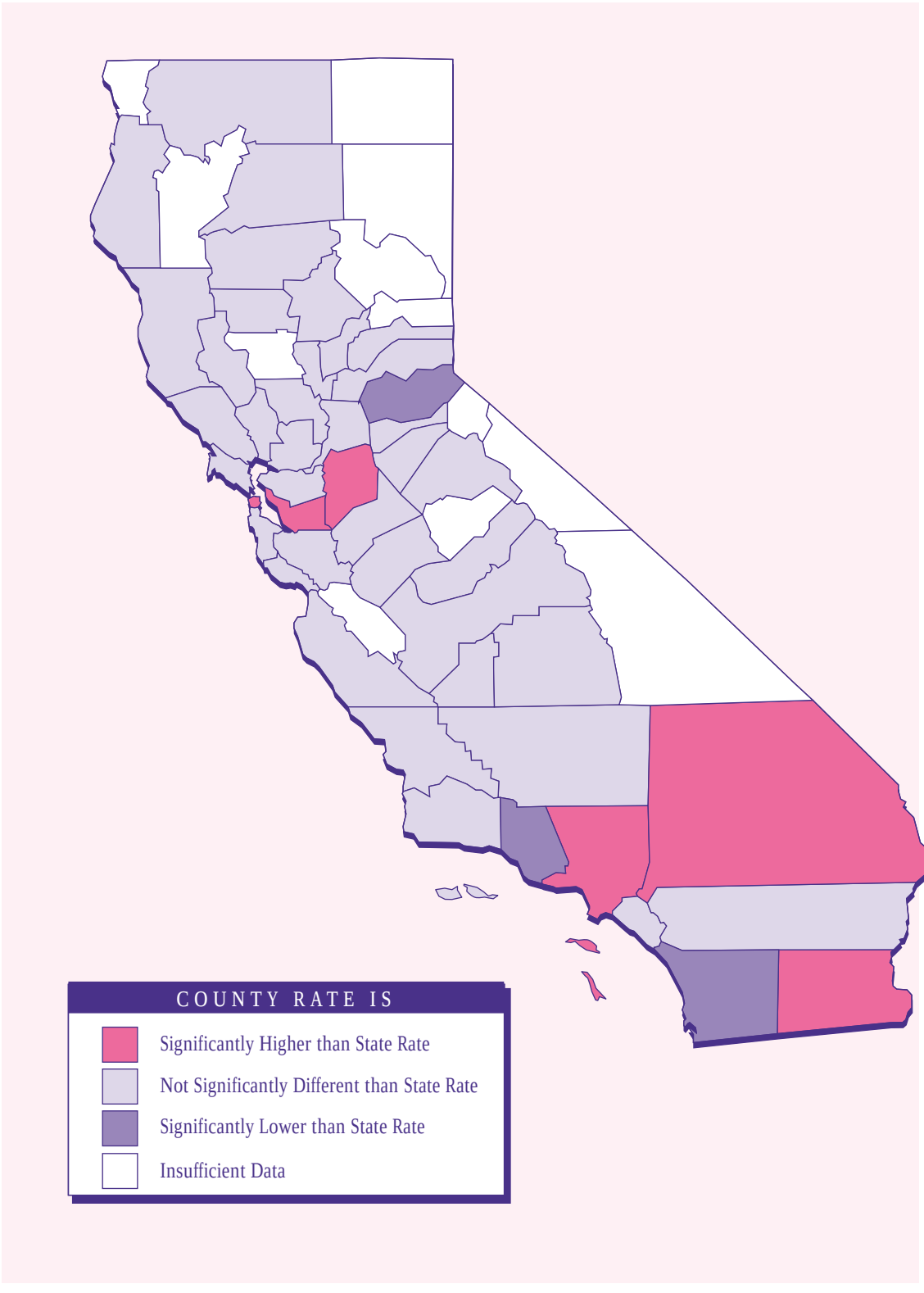
• *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

Map 4: Counites with Stroke Mortality Rates Significantly Different from the State Rate for Males and Females in California, 1989-1991



MAP 5: COUNTIES WITH STROKE MORTALITY RATES SIGNIFICANTLY DIFFERENT FROM THE STATE RATE FOR MALES IN CALIFORNIA, 1989-1991



Map 6: Counties with Stroke Mortality Rates Significantly Different from the Sate Rate for Females in California, 1989-1991

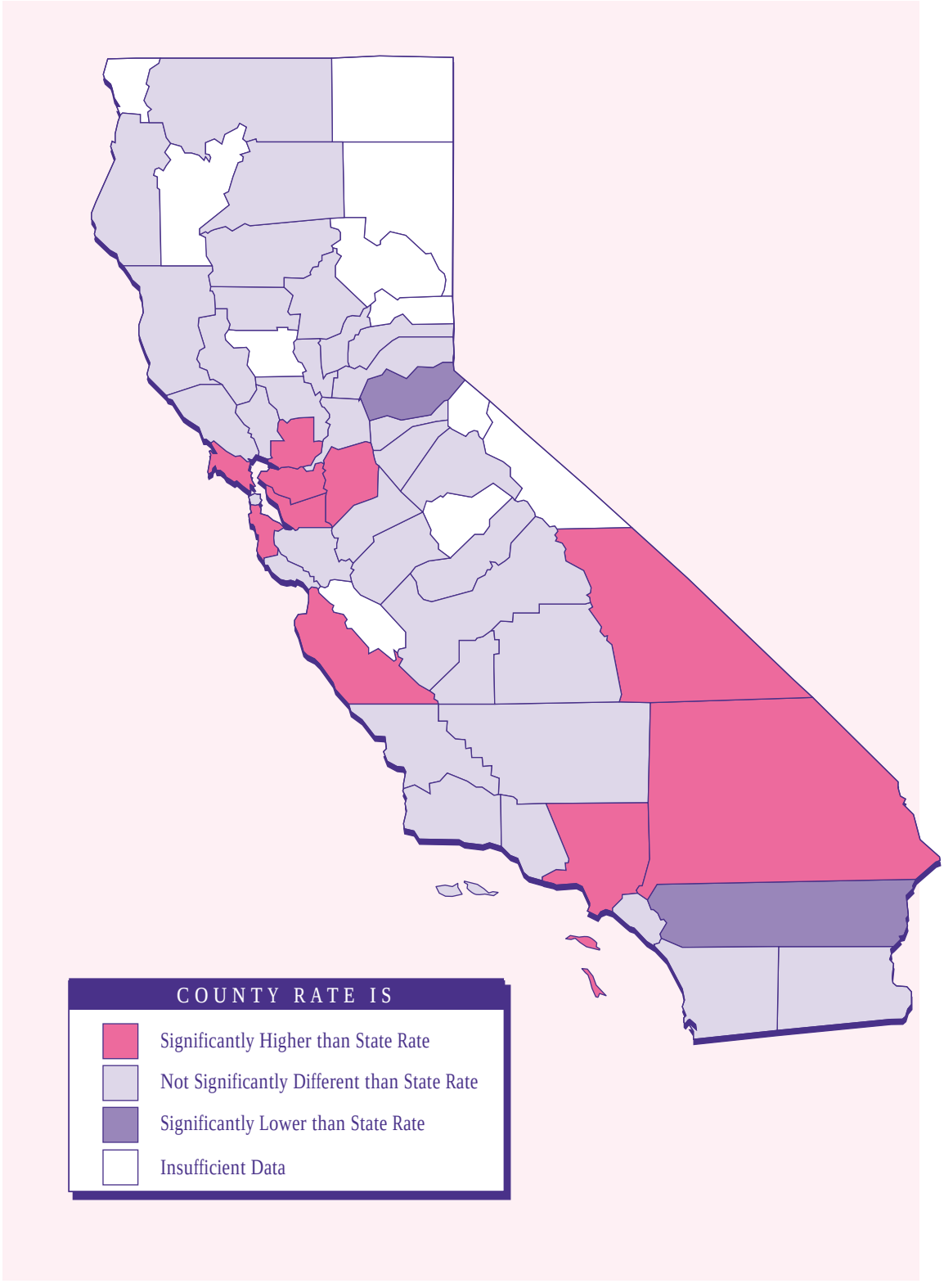


TABLE 9: STROKE DEATHS BY COUNTY FOR CALIFORNIA, 1989-1991

PLACE	MALE NUMBER	MALE PERCENT OF ALL DEATHS	FEMALE NUMBER	FEMALE PERCENT OF ALL DEATHS	TOTAL NUMBER	TOTAL PERCENT OF ALL DEATHS
CALIFORNIA	18,389	5.4	28,228	9.2	46,617	7.2
Alameda	923	6.1	1,383	9.6	2,306	7.8
Alpine	0	0.0	0	0.0	0	0.0
Amador	27	6.0	41	11.4	68	8.4
Butte	198	6.5	264	10.1	462	8.2
Calaveras	26	4.9	30	7.1	56	5.8
Colusa	7	3.1	10	5.4	17	4.1
Contra Costa	529	6.0	861	10.1	1,390	8.0
Del Norte	11	3.1	21	7.6	32	5.1
El Dorado	58	4.2	80	6.7	138	5.3
Fresno	377	4.9	513	7.6	890	6.1
Glenn	22	6.0	32	9.9	54	7.8
Humboldt	80	4.6	127	8.5	207	6.4
Imperial	90	6.1	90	9.6	180	7.4
Inyo	11	3.7	53	17.4	64	10.6
Kern	301	4.5	377	7.0	678	5.6
Kings	58	5.9	88	10.0	146	7.8
Lake	67	5.5	90	9.2	157	7.1
Lassen	6	2.1	14	6.7	20	4.0
Los Angeles	5,106	5.2	7,957	8.9	13,063	6.9
Madera	58	5.0	55	6.1	113	5.5
Marin	159	6.2	302	11.1	461	8.8
Mariposa	12	5.5	23	11.9	35	8.5
Mendocino	59	4.9	95	9.0	154	6.8
Merced	93	5.1	121	7.7	214	6.3
Modoc	5	3.4	8	6.1	13	4.7
Mono	3	5.6	3	9.1	6	6.9
Monterey	229	6.6	370	11.6	599	9.0
Napa	115	6.4	155	9.9	270	8.0
Nevada	65	5.8	95	9.3	160	7.5
Orange	1,151	5.2	2,018	9.2	3,169	7.2
Placer	124	6.1	169	9.0	293	7.5

(Continued)

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

TABLE 9: (CONTINUED) STROKE DEATHS BY COUNTY FOR CALIFORNIA, 1989-1991

PLACE	MALE NUMBER	MALE PERCENT OF ALL DEATHS	FEMALE NUMBER	FEMALE PERCENT OF ALL DEATHS	TOTAL NUMBER	TOTAL PERCENT OF ALL DEATHS
CALIFORNIA	18,389	5.4	28,228	9.2	46,617	7.2
Plumas	12	4.8	20	7.5	32	6.2
Riverside	892	5.5	1,136	8.6	2,028	6.9
Sacramento	635	5.3	974	8.9	1,609	7.0
San Benito	20	5.7	29	9.0	49	7.3
San Bernardino	854	5.4	1,178	8.6	2,032	6.9
San Diego	1,407	5.3	2,326	9.5	3,733	7.3
San Francisco	697	4.8	1,030	10.0	1,727	7.0
San Joaquin	397	6.4	521	10.0	918	8.0
San Luis Obispo	157	6.1	253	10.0	410	8.0
San Mateo	470	6.4	830	11.6	1,300	9.0
Santa Barbara	251	6.5	398	10.2	649	8.4
Santa Clara	709	5.7	1,198	9.7	1,898	7.7
Santa Cruz	151	6.0	258	10.2	409	8.1
Shasta	142	6.4	1,910	10.0	332	8.1
Sierra	1	1.9	2	5.6	3	3.4
Siskiyou	37	5.0	60	10.0	97	7.3
Solano	177	5.4	288	9.7	465	7.5
Sonoma	324	6.4	519	10.7	843	8.5
Stanislaus	243	5.4	364	9.3	607	7.2
Sutter	63	7.2	83	10.8	146	8.9
Tehama	51	5.5	82	11.1	133	8.0
Trinity	5	2.3	6	3.9	11	2.9
Tulare	237	5.9	295	8.5	532	7.1
Tuolumne	40	5.7	44	7.9	84	6.7
Ventura	310	5.1	536	9.4	846	7.2
Yolo	91	5.6	113	8.7	204	7.0
Yuba	46	5.6	59	9.7	105	7.3

Source: Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.

TABLE 10: AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) AND RELATIVE RATES FOR STROKE BY COUNTY, 1989-1991

	MALE		FEMALE		TOTAL	
PLACE	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE
CALIFORNIA	50.47	1.00	50.17	1.00	52.19	1.00
Alameda	59.90	1.19**	56.16	1.12**	58.29	1.12**
Alpine	•	•	•	•	•	•
Amador	36.24	0.72	47.49	0.95	41.13	0.79
Butte	51.28	1.02	49.51	0.99	50.80	0.97
Calaveras	35.15	0.70	32.54	0.65	33.49	0.64
Colusa	•	•	•	•	•	•
Contra Costa	54.71	1.08	56.51	1.13**	56.05	1.07
Del Norte	•	•	•	•	•	•
El Dorado	28.10	0.56*	31.74	0.63*	29.96	0.57*
Fresno	48.43	0.96	44.41	0.89	46.07	0.88*
Glenn	48.81	0.97	50.24	1.00	50.09	0.96
Humboldt	41.00	0.81	52.98	1.06	48.04	0.92
Imperial	71.06	1.41**	57.87	1.15	63.90	1.22
Inyo	•	•	87.75	1.75**	67.18	1.29
Kern	48.83	0.97	44.44	0.89	46.33	0.89*
Kings	59.10	1.17	65.50	1.31	62.42	1.20
Lake	46.33	0.92	53.94	1.07	50.98	0.98
Lassen	•	•	•	•	•	•
Los Angeles	53.17	1.05**	52.57	1.05**	53.19	1.02
Madera	46.48	0.92	35.07	0.70	40.01	0.77
Marin	49.81	0.99	66.86	1.33**	58.54	1.12
Mariposa	•	•	•	•	•	•
Mendocino	45.57	0.90	56.62	1.13	51.86	0.99
Merced	50.08	0.99	45.55	0.91	47.49	0.91
Modoc	•	•	•	•	•	•
Mono	•	•	•	•	•	•
Monterey	57.52	1.14	63.64	1.27**	61.46	1.18**
Napa	49.38	0.98	47.56	0.95	48.11	0.92
Nevada	•	•	39.19	0.78	48.02	0.92
Orange	48.11	0.95	48.46	0.97	48.69	0.93*
Placer	53.27	1.06	48.37	0.96	50.22	0.96

(Continued)

Notes: *Relative rate is ratio of county to statewide rate.*

* *County has significantly lower rate than state rate with an overall significance level of 0.10.*

** *County has significantly higher rate than state rate with an overall significance level of 0.10.*

• *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

TABLE 10: (CONTINUED) AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) AND RELATIVE RATES FOR STROKE BY COUNTY, 1989-1991

PLACE	MALE		FEMALE		TOTAL	
	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE	MORTALITY RATE	RELATIVE RATE
CALIFORNIA	50.47	1.00	50.17	1.00	52.19	1.00
Plumas	•	•	•	•	•	•
Riverside	48.42	0.96	45.57	0.91*	46.86	0.90*
Sacramento	53.30	1.06	52.27	1.04	53.02	1.02
San Benito	•	•	•	•	•	•
San Bernardino	58.02	1.15**	55.67	1.11**	56.81	1.09**
San Diego	45.31	0.90*	49.68	0.99	48.21	0.92*
San Francisco	58.98	1.17**	54.40	1.08	56.62	1.08**
San Joaquin	62.85	1.25**	58.14	1.16**	60.96	1.17**
San Luis Obispo	45.42	0.90	48.70	0.97	47.89	0.92
San Mateo	52.28	1.04	58.18	1.16**	56.27	1.08
Santa Barbara	48.58	0.96	47.23	0.94	47.92	0.92
Santa Clara	50.48	1.00	51.77	1.03	51.64	0.99
Santa Cruz	47.18	0.93	49.45	0.99	49.65	0.95
Shasta	57.40	1.14	55.21	1.10	56.80	1.09
Sierra	•	•	•	•	•	•
Siskiyou	56.08	1.11	63.84	1.27	61.99	1.19
Solano	53.58	1.06	63.42	1.26**	59.89	1.15
Sonoma	50.71	1.00	50.97	1.02	51.25	0.98
Stanislaus	51.86	1.03	49.55	0.99	50.77	0.97
Sutter	68.00	1.35	61.67	1.23	65.63	1.26
Tehama	71.20	1.41	53.52	1.07	56.90	1.09
Trinity	•	•	•	•	•	•
Tulare	62.25	1.23	51.24	1.02	56.23	1.08
Tuolumne	37.75	0.75	37.92	0.76	37.17	0.71
Ventura	41.01	0.81*	46.93	0.94	44.71	0.86*
Yolo	55.58	1.10	47.36	0.94	51.06	0.98
Yuba	56.99	1.13	59.29	1.18	58.93	1.13

Notes: *Relative rate is ratio of county to statewide rate.*

* *County has significantly lower rate than state rate with an overall significance level of 0.10.*

** *County has significantly higher rate than state rate with an overall significance level of 0.10.*

• *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

Appendix A

TECHNICAL NOTES

RATES

A frequent interest in epidemiology is the comparison of the rates for some event or characteristic across different populations. An adjusted rate, usually referred to as a crude rate or an overall rate, is obtained by dividing the total number of events of interest, i.e., deaths, by the total population at risk. A crude rate is usually expressed on a convenient base of 100,000. For example, in 1990, there were 46,284 IHD deaths in California among the population of 29,760,021. The crude 1990 IHD mortality rate was 46,284/29,760,021=55.5 per 100,000.

The stratum-specific rates are rates presented for individuals with certain characteristics in specific strata, such as different age and race/ethnic subgroups, divided by the total number of persons in the corresponding strata. For instance, there were 10,633 stroke deaths in 1990 among the California population, of persons who were 75 years of age or older, of 1,256,442. The age-specific 1990 stroke mortality rate was 10,633/1,256,442 = 846.3 per 100,000.

If the populations being compared were similar with respect to factors associated with the event under study, factors such as age, sex, race, or some social economical factors, there would be no problem in comparing the crude rates as they stand. However, if the study populations are not similarly constituted, the direct comparison of the crude rates would be misleading. For example, counties with a large component of elderly may have a higher death rate simply because the risk of dying is so strongly influenced by age. This effect of different composition among counties can be removed by age-adjusting.

The direct method of adjusting is used in this report. It is derived by applying the stratum-specific rates observed in each of the populations, i.e., counties, to a single "standard" or "reference" population. The age-adjusted rate is obtained by multiplying the age-specific rates by the corresponding stratum-specific proportions of the standard population and then summing the apportioned specific rates. The adjusted rate is also referred to as the standardized rate.

Adjusted rates allow us to put different populations on the same footing with respect to the effect of different compositions among populations. This single summary index for a population is more easily compared with other summary indices than are long lists of stratum-specific rates. However, the adjusted rates should be used with caution, since selecting different standard populations or choosing different stratum cut-offs for constructing strata, say age-stratum, would result in different numerical values of adjusted rates.

Note that the strata can constructed by more than one factor, say age and race, to adjust for these factors simultaneously. In this report, the age- and race-adjusted mortality rates were calculated for each county. The 1990 California population was chosen for the standard population in the report. The six age categories are 0-34, 35-44, 45-54, 55-64, 65-74, and 75+. Three race/ethnic groups were considered, white, black, and other, with age strata of younger than 65 years old. In this report, considering the statistical reliability of the age and race mortality rates by sex and county, race/ethnicity was collapsed into two groups, white and non-white, for age strata of 65-74 and 75+.

Appendix A

TECHNICAL NOTES

STATISTICAL ISSUES

The relative standard error of an estimate, say age- and race-adjusted mortality rate, is obtained by dividing the standard error of the estimate by the estimate itself. In other words, the relative standard error measures the spread, or the reliability of the estimate relative to the estimate itself. If the relative standard error is greater than 0.30, then we say the estimate is not statistically reliable. In this report we stated it as "insufficient data was available." Furthermore, for counties with the number of total IHD or stroke deaths less than 50, we also noted "insufficient data was available."

There are 58 counties in California. Therefore, the county:state ratio test would be performed 58 times for each sex subgroup. In this case, using single step Bonferroni procedure to control the type I error rate at 0.05 significance level would be too conservative. Thus, a step-down Bonferroni type of procedure based on p-values was implemented for this large number of comparisons, at 0.10 significance level, within each gender subgroup (2).

Appendix B

TABLE 11: 90% CONFIDENCE INTERVALS FOR AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) FOR IHD BY COUNTY, 1989-1991

COUNTY	MALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	FEMALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	TOTAL 90% CONFIDENCE INTERVALFOR MORTALITY RATE
CALIFORNIA	(190, 192)	(122, 123)	(156, 158)
Alameda	(188, 200)	(118, 126)	(149, 156)
Alpine	•	•	•
Amador	(110, 155)	(80, 115)	(98, 126)
Butte	(137, 160)	(79, 95)	(108, 121)
Calaveras	(150, 230)	(78, 112)	(118, 156)
Colusa	(170, 277)	(95, 159)	(139, 197)
Contra Costa	(155, 169)	(103, 112)	(126 134)
Del Norte	(128, 222)	(71, 135)	(107, 156)
El Dorado	(112, 139)	(70, 90)	(51, 313)
Fresno	(196, 213)	(125, 136)	(157, 167)
Glenn	(130, 195)	(84, 128)	(111, 149)
Humboldt	(192, 233)	(96, 120)	(143, 166)
Imperial	(227, 273)	(111, 141)	(169, 196)
Inyo	(171, 273)	(72, 115)	(120, 164)
Kern	(252, 274)	(158, 173)	(202, 215)
Kings	(209, 261)	(128, 164)	(169, 199)
Lake	(158, 231)	(107, 137)	(139, 170)
Lassen	(111, 173)	(74, 129)	(98, 138)
Los Angeles	(205, 210)	(146, 149)	(172, 175)
Madera	(192, 239)	(124, 156)	(161, 189)
Marin	(136, 160)	(88, 106)	(112, 126)
Mariposa	(131, 211)	(96, 157)	(121, 222)
Mendocino	(181, 231)	(92, 124)	(137, 166)
Merced	(185, 219)	(111, 133)	(147, 167)
Modoc	•	•	•
Mono	•	•	•
Monterey	(151, 173)	(82, 95)	(114, 126)
Napa	(188, 232)	(85, 112)	(136, 163)
Nevada	(111, 139)	(68, 99)	(90, 110)
Orange	(199, 209)	(128, 134)	(159, 164)
Placer	(148, 183)	(90, 119)	(120, 142)

(Continued)

Notes: • *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

TABLE 11: (CONTINUED) 90% CONFIDENCE INTERVALS FOR AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) FOR IHD BY COUNTY, 1989-1991

COUNTY	MALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	FEMALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	TOTAL 90% CONFIDENCE INTERVALFOR MORTALITY RATE
CALIFORNIA	(190, 192)	(122, 123)	(156, 158)
Plumas	(83, 137)	(71, 117)	(83, 118)
Riverside	(225, 237)	(143, 151)	(181, 188)
Sacramento	(181, 194)	(114, 122)	(144, 152)
San Benito	(123, 183)	(97, 146)	(119, 157)
San Bernardino	(256, 270)	(165, 175)	(207, 215)
San Diego	(165, 173)	(107, 112)	(134, 138)
San Francisco	(171, 185)	(104, 112)	(134, 142)
San Joaquin	(214, 234)	(136, 149)	(173, 184)
San Luis Obispo	(164, 191)	(98, 114)	(131, 147)
San Mateo	(172, 187)	(95, 104)	(130, 138)
Santa Barbara	(130, 147)	(79, 91)	(102, 112)
Santa Clara	(164, 176)	(106, 113)	(131, 138)
Santa Cruz	(136, 160)	(96, 113)	(116, 130)
Shasta	(168, 235)	(93, 113)	(131, 153)
Sierra	•	•	•
Siskiyou	(169, 228)	(114, 158)	(146, 181)
Solano	(172, 197)	(102, 118)	(135, 150)
Sonoma	(148, 166)	(94, 107)	(119, 129)
Stanislaus	(183, 206)	(102, 116)	(140, 153)
Sutter	(185, 237)	(94, 124)	(137, 165)
Tehama	(169, 232)	(80, 109)	(124, 152)
Trinity	(156, 247)	(55, 111)	(112, 163)
Tulare	(234, 261)	(139, 156)	(184, 199)
Tuolumne	(137, 192)	(74, 101)	(109, 146)
Ventura	(160, 176)	(95, 106)	(125, 134)
Yolo	(190, 228)	(109, 133)	(150, 171)
Yuba	(200, 258)	(114, 156)	(160, 193)

Notes: • *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

Appendix B

TABLE 12: 90% CONFIDENCE INTERVALS FOR AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) FOR STROKE BY COUNTY, 1989-1991

COUNTY	MALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	FEMALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	TOTAL 90% CONFIDENCE INTERVALFOR MORTALITY RATE
CALIFORNIA	(50, 51)	(50, 51)	(52, 53)
Alameda	(56, 63)	(54, 59)	(56, 60)
Alpine	•	•	•
Amador	(26, 50)	(36, 62)	(33, 50)
Butte	(45, 59)	(44, 56)	(46, 56)
Calaveras	(24, 49)	(23, 44)	(26, 42)
Colusa	•	•	•
Contra Costa	(51, 59)	(53, 60)	(54, 59)
Del Norte	•	•	•
El Dorado	(22, 35)	(26, 38)	(26, 35)
Fresno	(44, 53)	(41, 48)	(44, 49)
Glenn	(33, 70)	(36, 68)	(39, 63)
Humboldt	(34, 49)	(44, 63)	(42, 55)
Imperial	(59, 85)	(48, 69)	(56, 72)
Inyo	•	(68, 112)	(52, 84)
Kern	(44, 54)	(41, 48)	(43, 49)
Kings	(47, 74)	(54, 78)	(54, 72)
Lake	(37, 58)	(40, 70)	(42, 61)
Lassen	•	•	•
Los Angeles	(52, 54)	(52, 54)	(52, 54)
Madera	(37, 58)	(27, 44)	(34, 47)
Marin	(43, 58)	(58, 77)	(53, 64)
Mariposa	•	•	•
Mendocino	(34, 59)	(44, 71)	(43, 61)
Merced	(42, 60)	(39, 53)	(42, 53)
Modoc	•	•	•
Mono	•	•	•
Monterey	(51, 64)	(58, 69)	(57, 66)
Napa	(41, 58)	(39, 58)	(42, 54)
Nevada	•	(33, 46)	(34, 63)
Orange	(46, 51)	(47, 50)	(47, 50)
Placer	(44, 63)	(37, 61)	(43, 58)

(Continued)

Notes: • *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

TABLE 12: (CONTINUED) 90% CONFIDENCE INTERVALS FOR AGE- AND RACE-ADJUSTED MORTALITY RATES (PER 100,000) FOR STROKE BY COUNTY, 1989-1991

COUNTY	MALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	FEMALE 90% CONFIDENCE INTERVAL FOR MORTALITY RATE	TOTAL 90% CONFIDENCE INTERVALFOR MORTALITY RATE
CALIFORNIA	(50, 51)	(50, 51)	(52, 53)
Plumas	•	•	•
Riverside	(46, 51)	(43, 48)	(45, 49)
Sacramento	(50, 57)	(50, 55)	(51, 55)
San Benito	•	•	•
San Bernardino	(55, 63)	(53, 58)	(55, 59)
San Diego	(43, 47)	(48, 51)	(47, 50)
San Francisco	(55, 63)	(51, 58)	(54, 59)
San Joaquin	(58, 68)	(54, 63)	(58, 64)
San Luis Obispo	(39, 53)	(43, 55)	(43, 53)
San Mateo	(48, 56)	(55, 62)	(54, 59)
Santa Barbara	(44, 54)	(43, 52)	(45, 51)
Santa Clara	(47, 54)	(49, 54)	(50, 54)
Santa Cruz	(41, 54)	(44, 56)	(45, 54)
Shasta	(48, 68)	(48, 64)	(51, 63)
Sierra	•	•	•
Siskiyou	(38, 78)	(46, 84)	(49, 77)
Solano	(47, 61)	(57, 70)	(55, 65)
Sonoma	(46, 56)	(47, 55)	(48, 55)
Stanislaus	(46, 58)	(45, 54)	(47, 55)
Sutter	(54, 84)	(51, 74)	(57, 75)
Tehama	(44, 104)	(44, 64)	(47, 68)
Trinity	•	•	•
Tulare	(55, 70)	(46, 57)	(52, 61)
Tuolumne	(28, 49)	(27, 51)	(30, 45)
Ventura	(37, 45)	(44, 51)	(42, 47)
Yolo	(46, 66)	(40, 56)	(45, 57)
Yuba	(44, 73)	(47, 74)	(50, 69)

Notes: • *Insufficient data was available.*

Source: *Cardiovascular Disease Outreach, Resources & Epidemiology (CORE) Program. California Department of Health Services and University of California, San Francisco.*

References

1. Flanders, WD. Approximate Variance Formulas for Standardization of Rates. *Journal of Chronic Diseases*, 1984; 37:449-453.

2. Hochberg Y and Tamhane AC. *Multiple Comparison Procedures.* New York: John Riley & Sons, 1987.

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